



January 24, 2012

Ms. C. Elizabeth Gibson, Town Manager
Town of Nantucket
16 Broad Street
Nantucket, MA 02554

Re: **Summary Update for the Nantucket Harbor MEP Linked Model Technical Memorandum
Dated January 4, 2012**

Dear Ms. Gibson:

The following summarizes the work completed by the University of Massachusetts Dartmouth School of Marine Science and Technology Coastal Systems Group (SMAST) for the Town of Nantucket on Nantucket Harbor. Nantucket is the site of four SMAST Massachusetts Estuaries Program (MEP) projects that identify Nitrogen thresholds in the following embayment areas:

- Sesechacha Pond (Completed)
- Nantucket Harbor (Completed)
- Madaket Harbor / Long Pond (Completed)
- Hummock Pond (in queue)

SMAST completed three MEP Reports for the above embayment areas and produced Technical Memorandums with individual recommended "scenarios" or "plans of action" to reduce the Nitrogen enrichment in order to restore the quality habitat in these embayments areas. There are many "scenarios" that can be developed for each embayment for SMAST to evaluate to see if they will meet the Total Maximum Daily Loads (TMDLs) established as a result of the MEP Reports and for which the Massachusetts Department of Environmental Protection (MassDEP) will enforce. These include, but are not limited to, removing on-site wastewater disposal systems, reducing fertilizers within watersheds, treating stormwater, etc.

This summary deals with the Nantucket Harbor MEP, subsequent TMDLs and scenarios evaluated to date to provide solutions to meet the TMDLs. There is opportunity during the CWMP Update process to evaluate other "scenarios", completed as model runs by SMAST, in order to identify alternative solutions to meet the TMDL requirements. It is in the Town's best interest to find and develop solutions that not only meet the target thresholds, but in most cases exceed thresholds in order to preserve the quality and integrity of Nantucket's water resources.

The "Updated Technical Memorandum" on the Nantucket Harbor MEP Linked Model was received on Friday, January 6, 2012. It contains the additional (now a total of four) model run requested of SMAST for the Nantucket Harbor MEP Linked Model. The additional model run (not included in the Draft August 23, 2011 TM) includes data and results by raising the jetties in the Harbor without utilizing any land-based solutions.



The four model run scenarios are as follows:

Scenario 1 – Sewering the Monomoy Needs Area (as shown delineated in the 2004 CWMP and included in the 2012 TM). This includes ONLY the currently developed lots and no future build-out.

Scenario 2 – Sewering the Monomoy and Shimmo Needs Areas (as shown delineated in the 2004 CWMP and included in the 2012 TM). This includes ONLY the currently developed lots and no future build-out.

Scenario 3 – Elevating the Jetties – exclusive of any land-based solutions

Scenario 4 – Sewering Monomoy/Shimmo AND raising the jetties in the Harbor - combination of sewerage the two Needs Areas as delineated in the 2004 CWMP in conjunction with raising the jetties. This includes ONLY the currently developed lots and no future build-out.

All scenarios above result in lower Nitrogen levels in the Harbor; however, none of them meet the requirements of the two TMDLs established by MassDEP (threshold Nitrogen levels at both sentinel stations located in Nantucket Head of Harbor and East Polpis Harbor).

The model runs show that sewerage alone (as in the scenarios above) in the Nantucket Harbor area will not meet the TMDLs established at either the Nantucket Harbor or East Polpis sentinel stations. The TMDLs require Nitrogen reductions, as in the following Table, in order to meet the maximum Nitrogen load allowed in order to maintain required water quality as per threshold established:

TABLE: Embayment Area, Present Watershed Nitrogen Loading Rate, Target Threshold Nitrogen Loading Rate, and Difference Necessary to Achieve the Target Threshold Load

Embayments	Present Watershed Load ¹ (kg/day)	Target Threshold Watershed Load ² (kg/day)	Difference
Head of Harbor	1.86	0.79	1.07
Quaise Basin	2.12	1.14	0.98
Town Basin	12.22	10.71	1.51
Polpis Harbor	3.52	2.18	1.34
TOTAL	19.72 kg/day	14.89 kg/day	4.9 kg/day

¹ Composed of combined fertilizer, runoff, on-site wastewater disposal system loads and atmospheric deposition to natural surfaces.

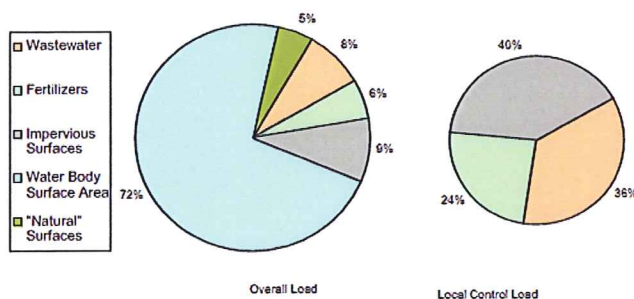
² Target threshold watershed load is the load from the watershed needed to meet the target threshold Nitrogen concentrations. See Figure below for graphic of this text. Refer to Figure on Page 4 for Sentinel Station locations.



The above TABLE clearly shows that a reduction of **4.9 kg/day of Nitrogen** in Nantucket Harbor at the two sentinel stations (Head of Harbor and East Polpis) is needed to meet the target threshold - the maximum Nitrogen loading allowed in order to maintain required water quality. Based on this **4.9 kg/day**, the Town is evaluating projects that can reduce the Nitrogen loading in the overall Harbor that will reach this goal.

The MEP Report completed for Nantucket Harbor identifies the Nitrogen loadings to the Harbor as wastewater, fertilizers, impervious surfaces, water body surface area and atmospheric deposition - see Figure below. The MEP also details those contributors that can be controlled under local regulatory control as on-site wastewater disposal systems, fertilizers and impervious surfaces. Atmospheric deposition - nutrients received through the atmosphere cannot be controlled, nor can the water body surface areas themselves. In evaluating solutions to reduce the Nitrogen loading to the receiving waters, we are looking towards the locally controllable means. Refer to the Figure below for a description of the Nitrogen loadings from the MEP Report:

MASSACHUSETTS ESTUARIES PROJECT



a. Nantucket Harbor System Overall

The above Figure details all the Nitrogen contributors in the overall Nantucket Harbor system. The circle on the left details **ALL** Nitrogen contributors and the circle on the right shows those contributors that can be **LOCALLY CONTROLLED**. The controllable contributors are stormwater at 40%, wastewater at 36% and fertilizer at 24%. Based on this, it makes sense to look at projects that can reduce these sources, and ultimately their Nitrogen loading, from the overall Harbor Watershed.



The Figure below, from the November 2006 Nantucket Harbor MEP Report, shows the sentinel station locations (both SMAST and Town) where water quality data was collected and evaluated to attain the results previously stated.

MASSACHUSETTS ESTUARIES PROJECT

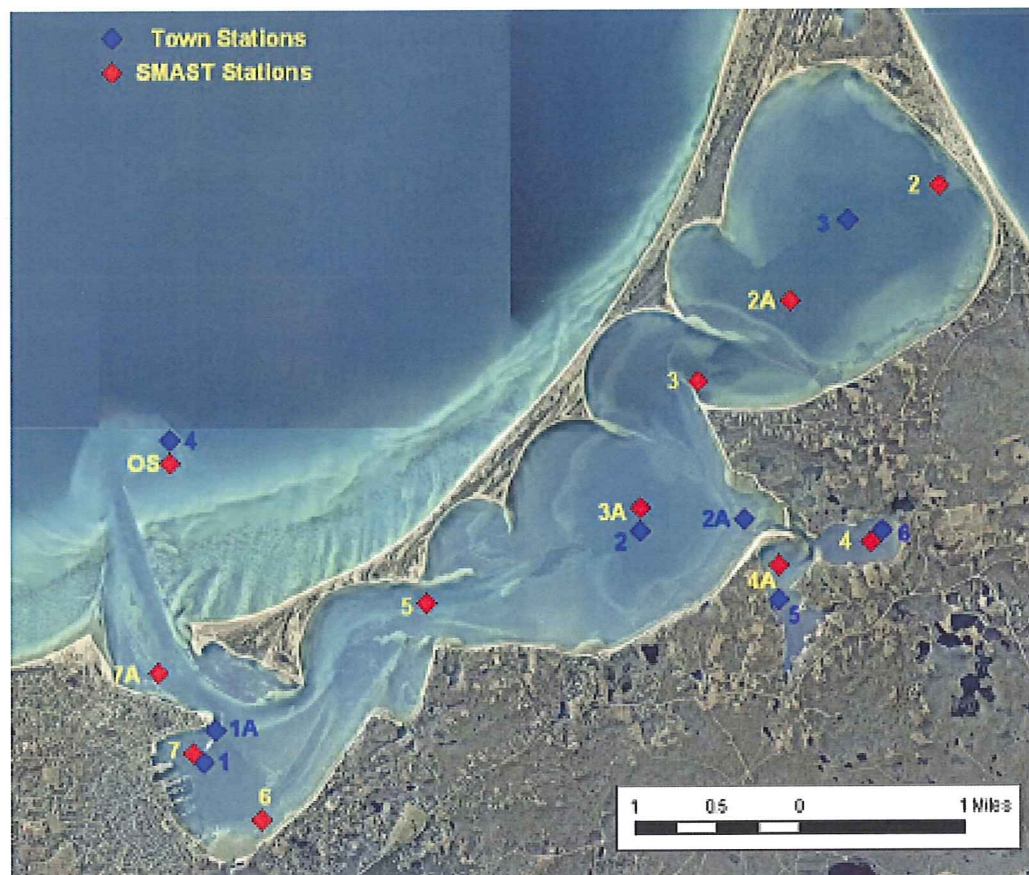


Figure VI-1. Estuarine water quality monitoring station locations in the Nantucket Harbor estuary system. Station labels correspond to those provided in Table VI-1.

The two scenarios in this Technical Memorandum that show promise in their ability to reduce the Nitrogen loading in the overall Harbor System are Scenarios 3 and 4. One is only the tidal flushing - which is not a land-based solution, but could provide a cleansing action by flushing fresh tidal water further into the Harbor thus removing nutrients as the tide flows back out to sea. The other deals with removing wastewater from the Harbor (a controllable source of Nitrogen) and adds a tidal flushing solution with the wastewater removal.

Scenario 3 – Raising the jetties without any land-based solution (no sewerage in Monomoy or Shimmo) attains the threshold Nitrogen level of the May 12, 2009 established TMDL at the sentinel station at the Head of the Harbor and comes very close to attaining the Nitrogen threshold level at East Polpis. We need to further review any potential sewerage for future developable parcels within Monomoy to see if this land-based solution will assist raising of the jetties to meet both TMDLs established in this area.



Scenario 4 – Sewering existing properties in Monomoy and Shimmo AND raising the jetties meets the TMDL established in Nantucket Head of Harbor, but does not meet the TMDL established in East Polpis. This solution comes very close to meeting both TMDLs, but falls just shy in meeting the TMDL established in East Polpis. Again, this is but one solution evaluated in this scenario and needs to be further explored.

The additional work completed by SMAST in Scenario 1, adding full build - out of all developable lots in the Monomoy Needs Area and sewerage currently existing AND build-out parcels, results in the same as sewerage existing dwellings in Monomoy and Shimmo (Scenario 2). So, it could be assumed that, if the Town continues sewerage Monomoy AND sewers future developable parcels in this Needs Area, while also raising the jetties, both Nitrogen threshold levels (Nantucket Harbor and East Polpis Harbor) could be met. This could be evaluated in another model run by SMAST in the CWMP Update to see if this particular scenario could meet the TMDLs. The 2004 CWMP recommended sewerage Monomoy and included full build-out, so estimated flows from the 2004 Report would encompass this.

In summary, these are four “scenarios” and their respective results in attempting to reduce the Nitrogen loading to Nantucket Harbor by **4.9kg/day**. There are other “scenarios” that could be evaluated.

The planned CWMP Update includes tasks to further research alternative solutions to meet not only the target Nitrogen thresholds, but a host of other criteria in order to protect and preserve our water resources. We will look at the “Big Picture” when evaluating solutions, including technical feasibility, costs, and local, state and federal permitting required and the potential for any negative impacts. For example, by raising the jetties, there are a host of “caveats” that must be taken into consideration and further evaluated, including, but not limited to the following:

- Technical aspects of design and construction to raise the jetties
- Approval by Army Corps of Engineers (ACOE)
- Approval by regulatory agencies – MassDEP, Coastal Zone Management, etc.
- Town approval and acceptance
- Timeframe to permit, design and construct – when will this solution be actively reducing Nitrogen
 - Will MassDEP accept the schedule and/or solution
- Ability to raise and/or leverage the funds to design and construct the project
- Environmental and other impacts, both direct and indirect will need review including:
 - Marine and Coastal Resources
 - Fisheries and Shellfisheries
 - Historical, Archaeological, Cultural, Conservation and Recreation
 - Surface and Groundwater Resources
 - Displacement of Business, Services, etc.
 - Noise, Air, Odor and Public Health Pollution
 - Federal, State and local laws
 - Changes in Development or Land Use Patterns
 - Damage to Ecosystems
 - Boating
 - Fishing
 - Other Economic Development Opportunities



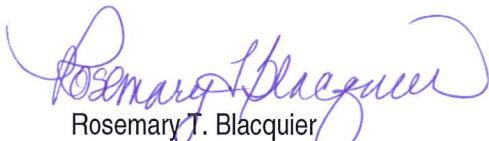
IMPORTANT NOTE:

The results contained in the January 4, 2012 TM are all related specifically to Nitrogen reductions and do not take into account any of the other multiple criteria required by MassDEP and used in the 2004 CWMP to establish "Need" for wastewater solutions other than on-site wastewater disposal. One of the major criterion in 2004 was a Needs Area based on these "other" criteria being located within the Nantucket Harbor Watershed District. The identified Needs Areas of Monomoy and Shimmo are wholly within this District and continue to contribute nutrients and degradation other than Nitrogen from on-site wastewater disposal systems!

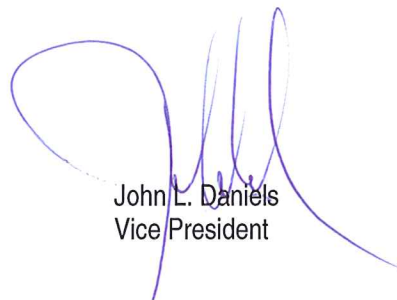
All of the information contained in the January 4, 2012 TM will be further evaluated and incorporated into the proposed CWMP Update planned to start later in 2012. The Update is mandated by MassDEP to include the results of all Massachusetts Estuaries Projects on Island and their resultant TMDLs. The information contained in the January 4, 2012 TM will be added to the list of criteria that was established, approved by MassDEP and utilized in the 2004 CWMP, as well as any new criteria that has come to fruition since 2004. The updated criteria list will be utilized to reassess and update areas of wastewater disposal "Need" on Island in order to determine any potential changes to the 2004 identified areas of "Need".

Sincerely,

WOODARD & CURRAN INC.



Rosemary T. Blacquier
Technical Leader



John L. Daniels
Vice President

RB/rb
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Enclosure(s)